

wastenotIOWA, Inc.

Waste Not with Plasma Arc

Charlie Kress

Municipal Solid Waste (MSW)

- U S Annually Produces 230 Million Tons of MSW
 - 30% is Recycled (About 45% in Linn County)
 - 14% is Incinerated
 - 56%, or About 130 Million Tons, is Landfilled
- Energy Act of 2005 Recognizes MSW as a Renewable Energy Source
 - Energy in U. S. Solid Waste is Nearly 10 Times That Available From Wind Power
- Environmental Impact of Landfills
 - Second Largest Human Contribution To Methane in Atmosphere
 - Hazardous Materials Leach Into Surrounding Land & Water Sources
 - If Incineration, Fly/Bottom Ash is a Problem

Landfills

Harm the Environment!

Waste Land!

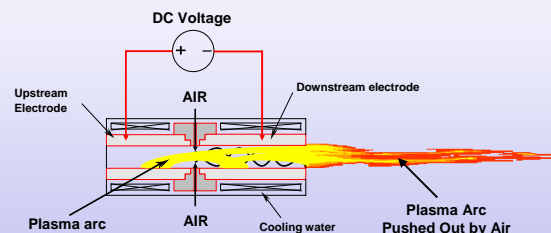
Waste Energy!

What is Plasma?

PLASMA is generated by ionizing a gas, either by heating it to a high temperature or by passing high-energy electrons through it. Examples:

- Lightning
- Stars
- Fluorescent
- Bulbs
- Neon Signs
- Welding Arcs
- Metal Cutting Torches

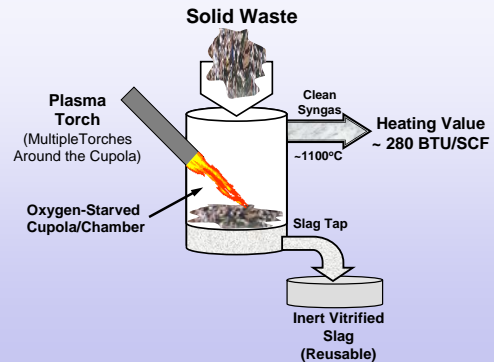
Plasma Arc Torch



Plasma Torch A Mature Technology

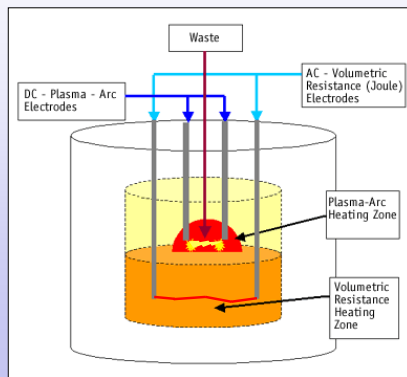
- **Late 1800's:** Plasma Arc Heater Developed For Metal Industry
- **Early 1900's:** Plasma Heaters Used In The Chemical Industry
- **1950's:** Plasma Arc Cutting & Welding
- **1960's:** Used To Simulate Heat Of Spacecraft Re-entry
- **1990's:** Plasma Arc Utilized In Steel Mill Operations
- **1991:** Plasma Research Facility Founded at Georgia Tech
- **1998:** Plasma Municipal Solid Waste Plant Operational In Japan
- **Today:** Used in Industrial Plants Worldwide
 - Chemical Industry
 - Metallurgical Industry
 - Waste/Environment Industry

Plasma Torch Treatment of Solid Waste

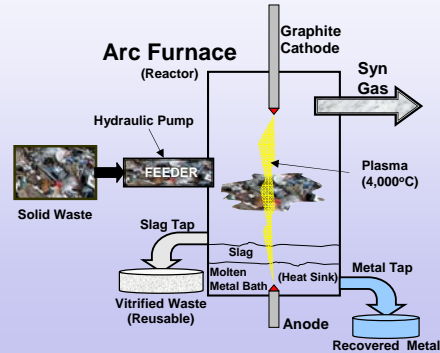


Not an Incineration Process!

EIT's Plasma Enhanced Melter



Alternate Plasma Arc System: Non-Torch, DC Carbide Electrodes



Plasma Reactor Syngas Toxic & Particulate Emissions

Emission Parameter	Units	U.S. EPA Limits	European Union Limits	From Plasma Reactor
Dioxins/Furans	NgTEQ/dscm	0.2	0.1	<0.05
Particulates	Mg/dscm	34	20	<10
HCL Gas	ppmv	15	7	4
NOx Gas	ppmv	103	159	80
SO2 Gas	ppmv	3.1	10	2

Plasma Reactor Slag Leachability

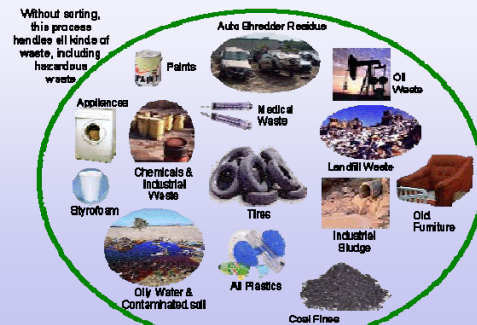
	Permissible Concentration Metal (mg/l)	Plasma Treatment Measured Concentration (mg/l)
Arsenic	5.0	<0.1
Barium	100.0	<0.5
Cadmium	1.0	<0.02
Chromium	5.0	<0.2
Lead	5.0	<0.2
Mercury	0.2	<0.01
Selenium	1.0	<0.1
Silver	5.0	<0.5

The US Environmental Protection Agency (EPA) & the European Union (EU) classify plasma slag as **inert!**

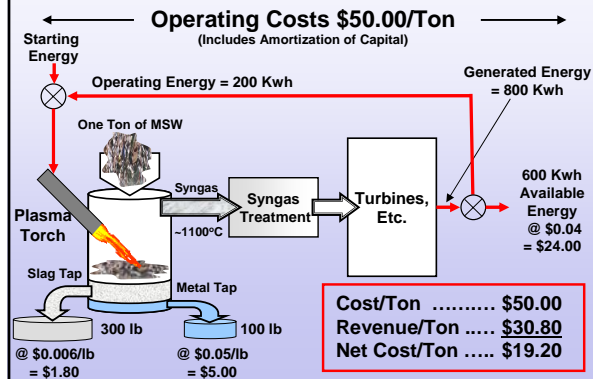
Plasma Arc Technology: Ideal For Waste Treatment

- Waste Exposed To Plasma Heated To $>2,000^{\circ}\text{C}$
 - Inorganic Material Melted/Vitrified Into Reusable **Inert** Glass-Like Slag
 - Organic Compounds Dissociated Into Simple Molecules
 - Hydrogen
 - Carbon Monoxide
 - Carbon Dioxide
 - Water Vapor
 - Nitrogen
 - Methane
- Clean Syngas**
- The Key is High Temperature & Oxygen-Starved Chamber

Waste Types Handled by Plasma Technology (From Recovered Energy, Inc.)



Representative Recurring Costs



ZAPPED!

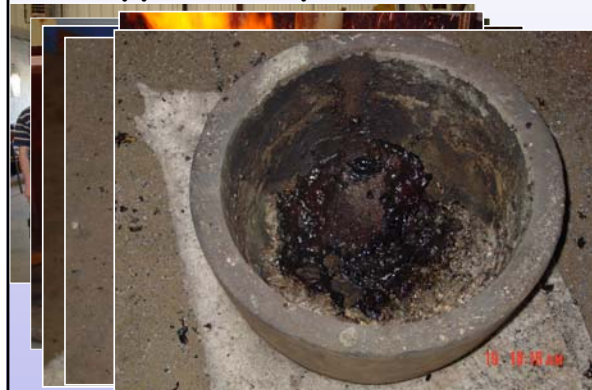


- Linn County Citizens Visited Georgia Tech Research Institute
- Host was Dr. Lou Circeo of the Plasma Research Center
- Applied Plasma Torch to Linn County Municipal Solid Waste
- Also Talked With Geoplasma, a Division of Jacoby Development
- Gazette Article by Dick Hogan



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Zapped!! (Trip to Atlanta)



Some Locations Considering Plasma for MSW

- Ottawa, Canada
- St. Lucie County, Florida
- International Falls, Minnesota
- Hartford, Connecticut
- Superior, Wisconsin
- Honolulu, Hawaii

Ottawa Demonstration Plasma Site

Construction begins for Plasco's Ottawa demonstration facility
 Tuesday September 19, 12:30 pm

OTTAWA, Sept. 19 /PRNewswire/
 - A ground breaking ceremony at the Trail Road site today marked the start of onsite construction of the Plasco Energy Group Inc. (Plasco) plant that will demonstrate the company's technology on a commercial-ready scale. Once complete, the Ottawa demonstration plant will showcase to the world a new environmental and cost-effective alternative for converting waste otherwise destined for landfill into saleable electricity.

- Ottawa Has Been Considering Plasma For Some Time
- Plasco Won Demo Contract
- Demo Unit = 90 Tons/Day
- Includes Power Generation
 - Generates 4.1 Mw/Day
 - Torch Uses 0.9 Mw/Day
 - Rest Will Power 3,000 Homes
- Won Over 24 Competitors
 - Many Technologies Were Bid

Plasco Trail Road Facility

Ground Breaking, September 18, 2006



Plant From the East Side, January 18, 2007



Cedar Rapids Gazette, 9/21/06

Florida garbage to be vaporized

WEST PALM BEACH, Fla. (AP) — A Florida county has agreed to send its solid waste to a new plant in St. Lucie County, where it will be burned and the resulting gas will be used to generate electricity. The plant, which is being built by Plasco Energy Group Inc., is expected to be operational by 2009. The plant will be able to process up to 2,000 tons of waste per day. The plant will also be able to generate up to 4.1 megawatts of electricity. The plant will be the first of its kind in the state. The plant will be a major step in the county's efforts to reduce its reliance on landfills. The plant will also be a major step in the county's efforts to reduce its carbon footprint. The plant will be a major step in the county's efforts to become a more sustainable community.



St. Lucie County Project: Some Details

- Requirements
 - 2000 Tons/per/Day of New Solid Waste plus
 - 1000 Tons/per/Day of Existing Landfill Remediation
 - Stated Treatment Cost of **\$32/ton** for Solid Waste
- Geoplasma Will:
 - Finance The Development (Cost: Approximately \$425 Million)
 - Build The Facility
 - Own The Facility
 - Operate The Facility for Profit
- Contract is in Final Negotiation
- Planned Plant Completion is 2009

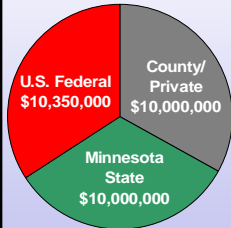
St. Lucie Project Team

- Geoplasma
- Westinghouse Plasma Corporation
- Energy Systems Group
- New Prospect Capital, LLC
- UBS
- Georgia Tech Research Institute
- Holland & Knight, LLP
- Edelman MACTEC Engineering and Consulting, Inc.

A Powerful Team!!

RECAP: International Falls, Minnesota

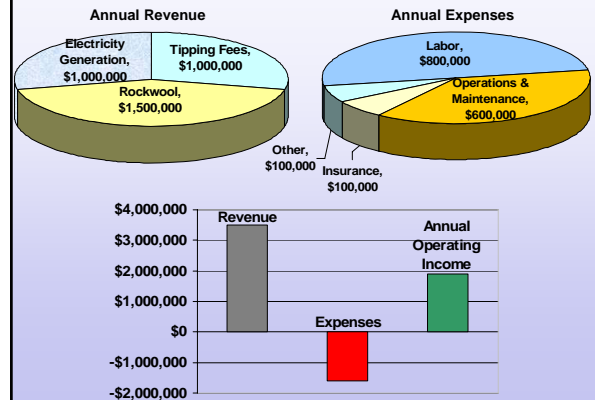
Funding Profile



- 100 Tons Per Day
- Will Produce Steam, Electricity & Rockwool
- Overall Project Development Leadership by Laurentian RC&D
- Many Private & Government Entities are Members of the Team
- Have Secured About \$14,000,000 of the \$30,350,000 Required For Construction
- Scheduled Plant Completion is 04/01/09
- Now in Project Feasibility Analysis

See Website www.lrcd.org, Click on Renewable Energy, Then RECAP

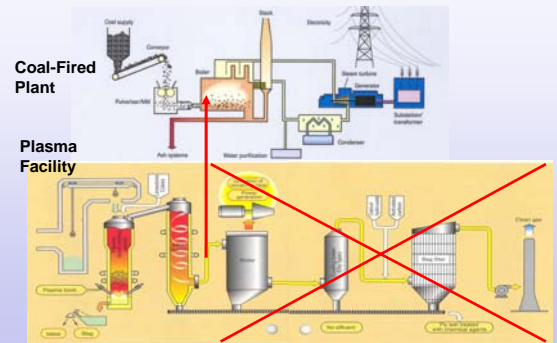
RECAP Fiscal Basics



Another Option:

Combining Plasma MSW Treatment With A Coal-Fired Plant

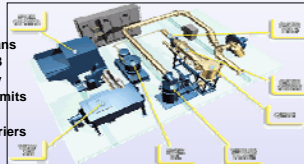
Combined With Coal-Fired Plant



Reduces Capitalization Cost, Improves Coal-Fire Operation

PyroGenesis PAWDS

- Plasma Arc Waste Destruction System
- Raw Waste Cannot Be Dumped Into Oceans
- Installed On Carnival Cruise Liner In 2003
- Typically Treats 5 Tons Of Waste Per Day
- Emissions Much Less Than EPA or EU Limits
- Inert Slag Can Be Deposited In Oceans
- Navy Is Exploring Its Use On Aircraft Carriers



Carnival Cruise Line's M/S Fantasy

Landfill-Free Iowa!



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Thank You!